AN ENDURING LEGACY FOR THE NEXT 75 YEARS

1663 asked Laboratory Director **Terry Wallace** how the Lab's illustrious history positions it for the scientific discoveries that will be needed in the future.

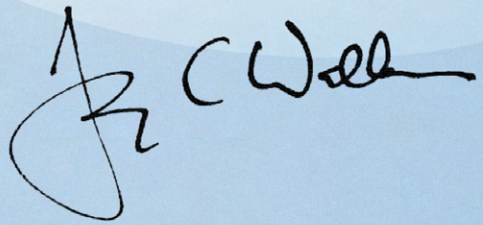
IN THE SPRING OF 1943, J. ROBERT OPPENHEIMER began to assemble his scientific team on the isolated mesas of the Pajarito Plateau in Northern New Mexico. This team comprised some of the brightest scientists from across the nation, as well as several refugee scientists from Europe. Most had only a modest inkling at best of the nature of the project they were going to be working on, so the first stop on this great scientific rendezvous was a series of lectures organized by an Oppenheimer protégé, Robert Serber. Serber had been working with Oppenheimer on a framework for nuclear-fission weapons for about a year and had remarkable skill in bridging theoretical and experimental views in nuclear physics. His lectures were attended by giants in the field, including Enrico Fermi, Hans Bethe, Edward Teller, and Stanislaw Ulam, along with scores of younger staff, many with newly minted PhDs. Serber introduced the lectures with a simple summary of why everyone had been called to Los Alamos: "The object of the project is to produce a practical military weapon in the form of a bomb in which the energy is released by a fast-neutron chain reaction in one or more of the materials known to show nuclear fission."

These lectures were legendary, and each lesson generated debate and new insights. Out of these lectures, the science plan for Los Alamos emerged. Scientists and engineers were based in disciplinary groups (theory, physics, chemistry, metallurgy, ordnance, etc.), and work began on hundreds of aspects of the problem. The pace of discovery was extraordinary. By the end of 1943, Bethe and Richard Feynman had developed a fundamental formula for the efficiency of nuclear chain reactions that could be used to calculate the yield of fission bombs, the first phase diagrams of the newly discovered element plutonium were determined (but remained to be fully explained for decades), and precisely timed exploding-bridgewire detonators were invented. As a measure of this scientific creativity, Los Alamos filed several thousand patents for various parts spanning an enormous scope. (The patents were filed in secret in order to hide the scientific path to an atomic bomb.)

The 75-year history of Los Alamos is rich with discovery. The science plan today is driven by the same principles as Oppenheimer's original plan: Define the hard problems that need to be solved and realize that the solutions must draw from a broad spectrum of disciplines. Los Alamos discoveries and technological advances have changed the way we live and how we understand the universe. Nuclear energy, nuclear medicine, the discovery of gamma-ray bursts, the invention of the heat pipe (which makes all smartphones possible), decoding the human genome, supercomputing, finding evidence of ancient lakes on Mars—all these breakthroughs are because of our interdisciplinary history.

The challenges in the coming decades—the next 75 years and beyond—are as formidable as those faced by the scientists and engineers that gathered on the Pajarito Plateau in 1943. Every year, the directors of the nation's nuclear-weapons laboratories are asked to assess the safety, security, and effectiveness of our nation's nuclear stockpile and report back to the Secretary of Energy and, ultimately, the President of the United States. Since the country's last nuclear test in 1992, we have used our expertise in science and engineering to do just that. The nuclear arsenal is the cornerstone of our country's strategic deterrent, and maintaining its credibility is the thrust of the Laboratory's work. From that work stems other critical missions—including supporting nuclear nonproliferation and counterproliferation. Our expertise in all things nuclear gives us the ability to develop tools to monitor the globe for nefarious nuclear activity, train international nuclear-facility inspectors, disable an improvised nuclear device, and conduct forensics on nuclear materials to determine their origin. We also use science to tackle emerging threats—whether they be biological, cyber, chemical, or climate. At every turn, we look at the biggest challenges to our national security and work to find scientific and engineering solutions.

None of this work is easy, but it is essential—and that is why we approach it with both rigor and respect—just as the men and women of the Manhattan Project did. It is an enduring legacy that will continue to guide us far into the future.



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